DEPARTMENT OF TRANSPORTATION
ENGINEERING SERVICE CENTER
Transportation Laboratory
P. O. Box 19128
Sacramento, California 95819

METHOD OF TESTING BRIDGE BEARING PADS

CAUTION: Prior to handling test materials, performing equipment setups, and/or conducting this method, testers are required to read "**SAFETY AND HEALTH**" in Part 4 of this method. It is the responsibility of the user of this method to consult and utilize departmental safety and health practices and determine the applicability of regulatory limitations before any testing is performed.

PART 1. DETERMINATION OF COEFFICIENT OF FRICTION AND FATIGUE LIFE

A. SCOPE

The procedures used to determine the fatigue life and coefficient of friction or internal shear resistance of various bearing pad assemblies such as bronze, elastomeric, TFE (Teflon), are described in Part 1 of this test method.

B. TESTING APPARATUS AND ACCESSORIES

1. An expansion bearing pad fatigue testing machine is required. See Figures 1 and 2.
2. Acetone.
3. A stopwatch, accurate to within 1s.
4. A strain indicator: Strainsert, Model HW2D or equivalent.
5. A 150-mm steel scale, graduated in 1-mm divisions.

C. TEST RECORD FORM

Use work card, Form TL-6028, for recording test data.

D. SPECIMEN PREPARATION

Clean all test specimens and both platens so that they are free of any foreign substances such as dust, grit, moisture, etc., except for the lubricants used in conjunction with the bronze specimens such as oil, grease, etc. Cut the elastomeric specimens to size (standard size 150 by 150 mm) and wipe clean. File smooth any rough edges on the bronze specimens and wipe clean. Use acetone to clean the bearing surfaces of TFE (Teflon) bonded specimens only.

E. TEST PROCEDURE

1. After the specimen has been centered on the lower platen of the fatigue machine, screw the eight platen leveling rollers far enough into the platen so that they do not contact the vertical guide plates.
2. Zero the strain indicator.
3. Apply vertical loads by operating Valve Nos. 1 and 2.
4. Then adjust Valve No. 6 to maintain the required pressure as read on Gage No. 2.
5. At this time the loading platens should be parallel; check this with the steel

scale. If loading heads are not parallel, unload the specimen and repeat the loading procedure.

6. Remove the "at rest" shims and screw the eight platen leveling rollers finger tight against the guide plates to maintain platen stability.

7. Operate the top-loading platen using the following procedure:

   a. Start the hydraulic pump (start button).

   b. Open Valve No. 5 all the way and then adjust Valve No. 4 to maintain the proper testing speed. Note: Valve No. 5 must be opened before speed can be adjusted by Valve No. 4.

   c. Adjust the testing speed by the use of a stop watch.

   d. Measure the horizontal load by use of the SR-4 strain indicator.

   e. The pressure indicated on Gage No. 3 is controlled by Valve No. 7. The function of Valve No. 7 is to control the pressure applied to the horizontal ram.

8. At the end of the test period, stop and unload the machine by reversing the loading steps.

F. HORIZONTAL FORCE MEASUREMENTS

During the course of the test, record the strain gage readings to determine the horizontal force.

1. Take static coefficient of friction readings at the instant of impending motion or slip between the surfaces in question. For flexible backed TFE (Teflon) bearings, measure strain at the point of maximum displacement.

2. Obtain kinetic coefficient of friction readings by taking the average reading while surfaces are sliding. Do this in both directions of movement.

G. CALCULATIONS

$$f = F/N$$

Where:

F = Horizontal force due to friction or internal shear resistance, in N

N = Normal force, in N

f = Coefficient of friction

f_s = Static

f_k = Kinetic

Determine F from the strain gage indicator readings by use of the calibration plot shown in Figure 3. Determine N by using the calibration plot in Figure 4. This value is the normal force indicated on Gage No. 2 in Figure 2.

H. REPORTING RESULTS

1. Report the following test results on test report Form TL-6028:

   a. Maximum static coefficient of friction.

   b. Average static coefficient of friction.

   c. Average kinetic coefficient of friction.

   d. Remarks concerning the specimen's appearance after completion of test, excessive wear, delamination, etc.

2. The "maximum friction coefficient", as determined on Form TL-6028, is defined as the highest coefficient as averaged over any 50 cycles of the test. The "average friction coefficient" is defined as the average of at least 5 and not more than 10 readings taken between 2000 and 8000 cycles. These readings shall be taken at intervals of not less than 500 cycles apart.

PART 2. DETERMINATION OF PEEL STRENGTH

A. SCOPE

The procedures used to determine the peel strength of elastomer bonded to metal or fabric reinforcement for elastomeric bearing pads are described in Part 2 of this test method.

B. TEST APPARATUS AND ACCESSORIES

1. The testing machine shall measure loads up to 0.5 tonne, accurate to within 0.005 tonne. The platen speed shall be maintained at 50 ± 5 mm / min.

2. Rubber grips shall have jaws at least 25 mm wide. The grips shall be capable of firmly gripping the specimen without slippage during the testing.

3. The saw shall be capable of cutting smoothly through elastomeric bearing pads that contain metal or fabric reinforcement.

C. SPECIMEN PREPARATION AND TESTING

1. Cut a 25-mm section (full thickness) from one side of the bearing pad samples as shown in Figure 6a. The minimum length shall be 150 mm.

2. Cut the section into test specimens as shown in Figure 6b.

3. Initiate peeling by neatly cutting neoprene back to neoprene-reinforcement interface. See Figure 6c.

4. Initiate uniform peeling by pulling on specimen. Separate the specimen a sufficient distance to permit clamping in the grips of the machine.

5. Install the specimen in the grips of the testing machine as shown in Figure 7. Care should be used in installing the specimen symmetrically so that the tension is applied uniformly. The grips shall concentrically maintain the specimen in a vertical direction during testing.

6. Apply the load at a uniform rate of 50 ± 5 mm / min for a distance of at least 50 mm.

7. Determine and record the peel strength in N / mm. The peel strength is defined as the average load recorded on the testing machine when the specimen is slowly and uniformly peeled without snagging or binding.

D. REPORTING OF RESULTS

Document results of tests with appropriate comments and notations on Form TL-0610. Report results (as complying or not complying with specifications) on Form TL-6039.

PART 3. DETERMINATION OF THE PHYSICAL PROPERTIES OF BRIDGE BEARING PADS

Except as shown in Parts 1 and 2, the other physical properties of bridge bearing pads shall be determined in accordance with the procedures as outlined in the appropriate American Society for Testing and Materials (ASTM) specifications or the American Association of State Highway Transportation Officials (AASHTO) specifications, as specified in the Standard Specifications.

PART 4. SAFETY AND HEALTH

Prior to handling, testing or disposing of any waste materials, testers are required to read: Part A (Section 5.0), Part B (Sections: 5.0, 6.0 and 10.0) and Part C (Section 1.0) of Caltrans Laboratory Safety Manual. Users of this method do so at their own risk.

REFERENCE:

Caltrans Standard Specifications

End of Text (California Test 663 contains 10 pages)

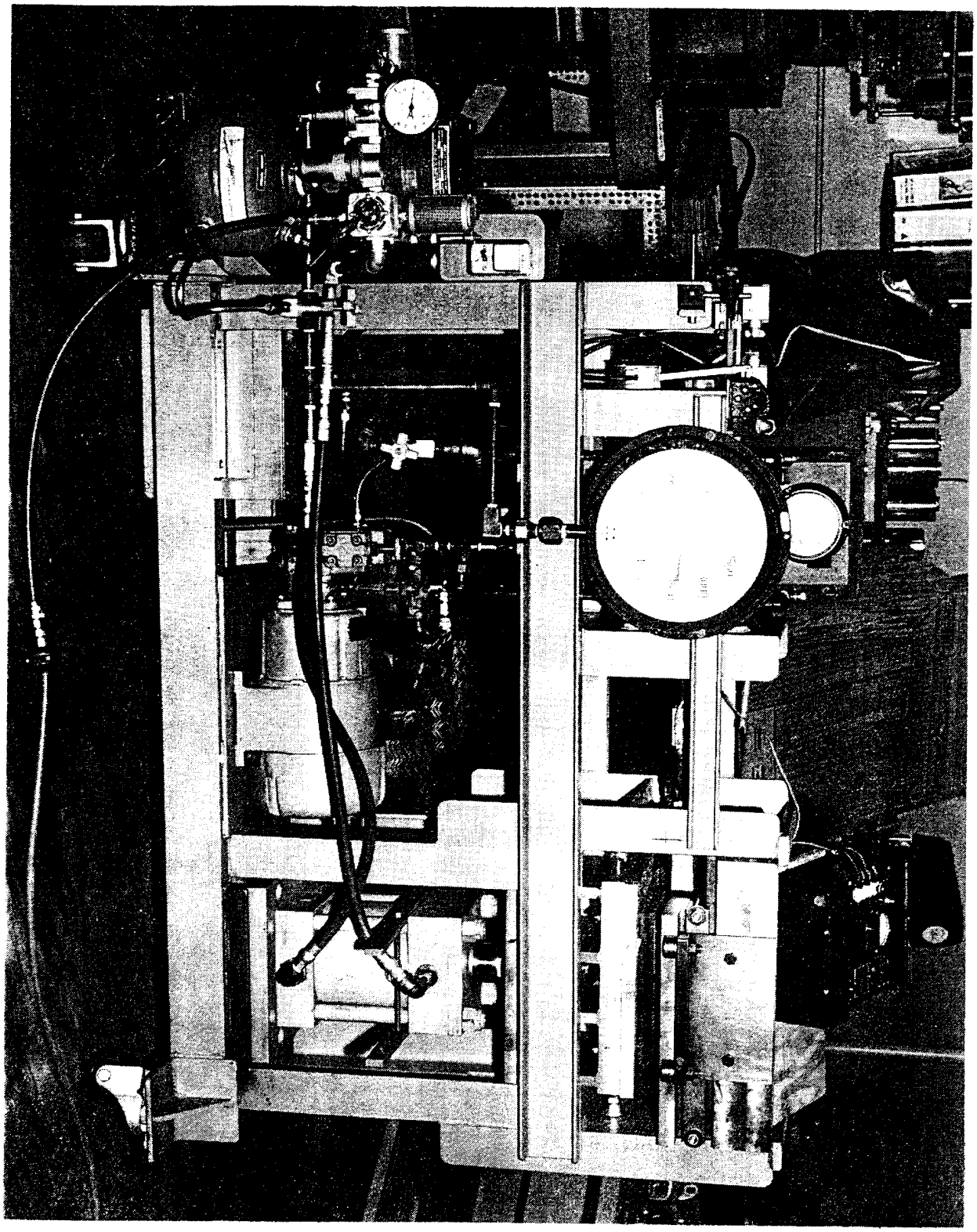


FIGURE 1

SCHEMATIC DIAGRAM OF FATIGUE TESTING MACHINE

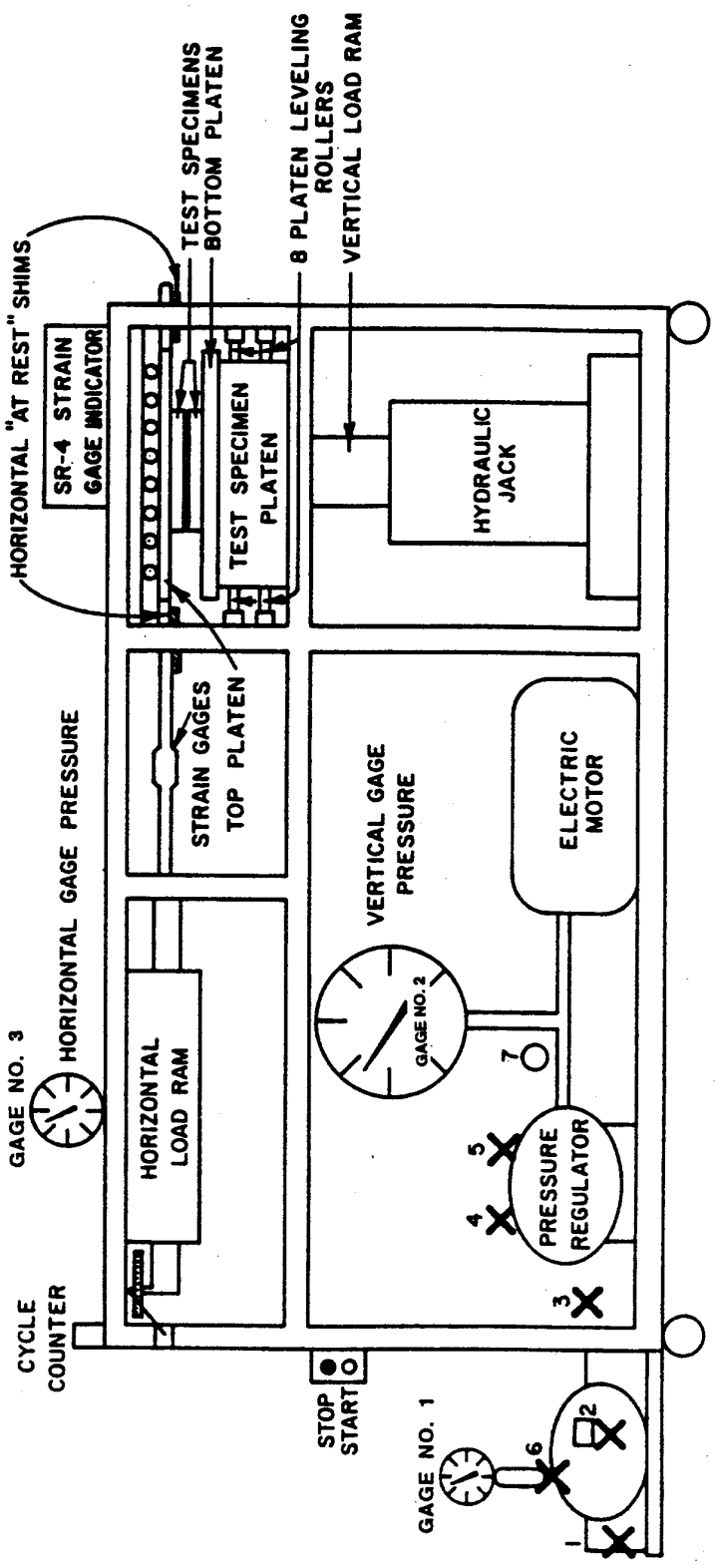
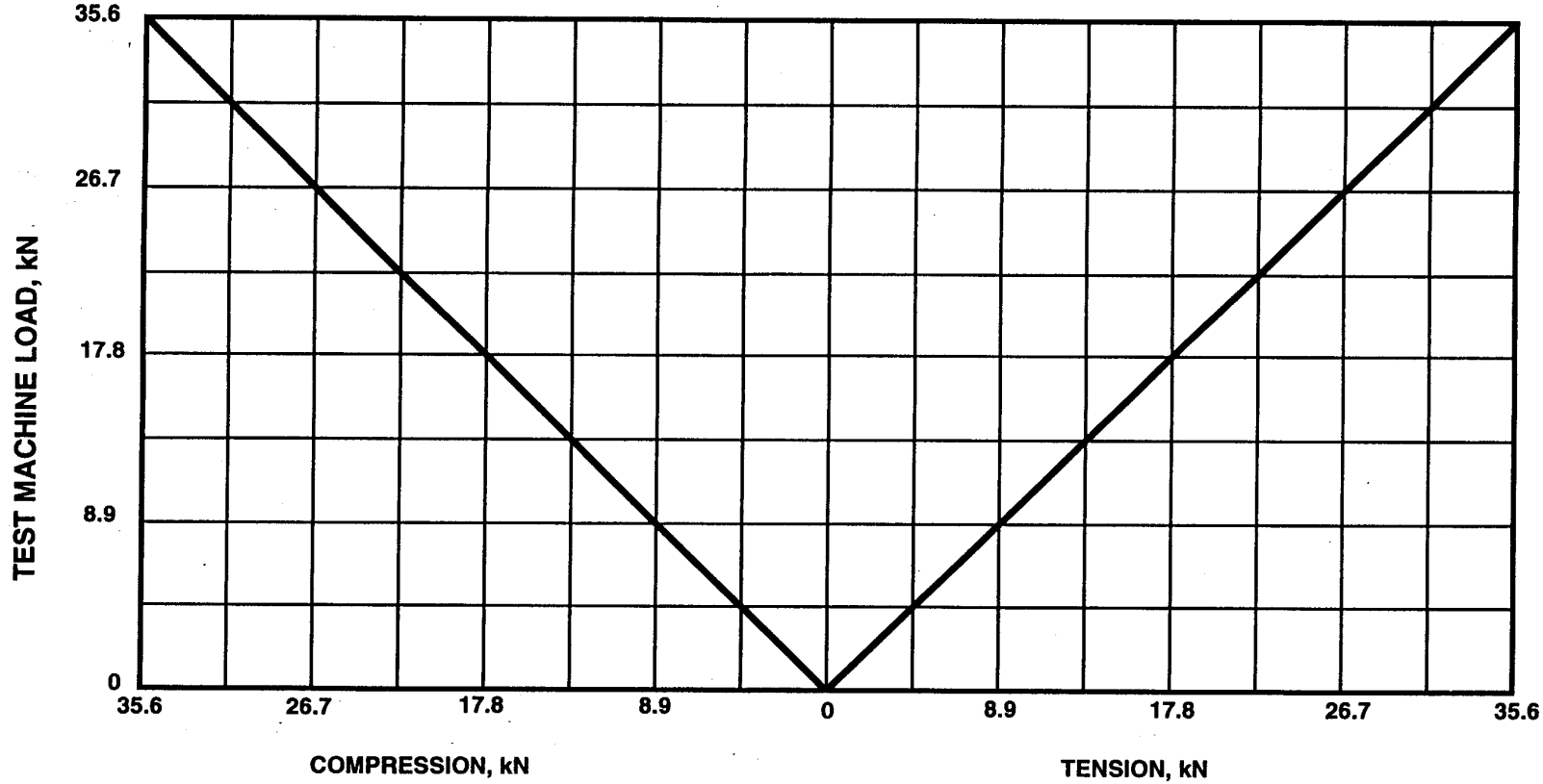


FIGURE 2

FIGURE 3

BEARING PAD FATIGUE TESTING MACHINE
HORIZONTAL LOAD CELL CALIBRATION



STRAINSERT INDICATOR 20 TURN MODEL HW2-D

SETTINGS - FB+
ua
GAGE FACTOR = 0.28 ±

NO LOAD BALANCE - 44.5 kN
CALIBRATION RESISTOR = 89.0 kN SETTING
CALIBRATION RESISTOR= PC 199.18 kN

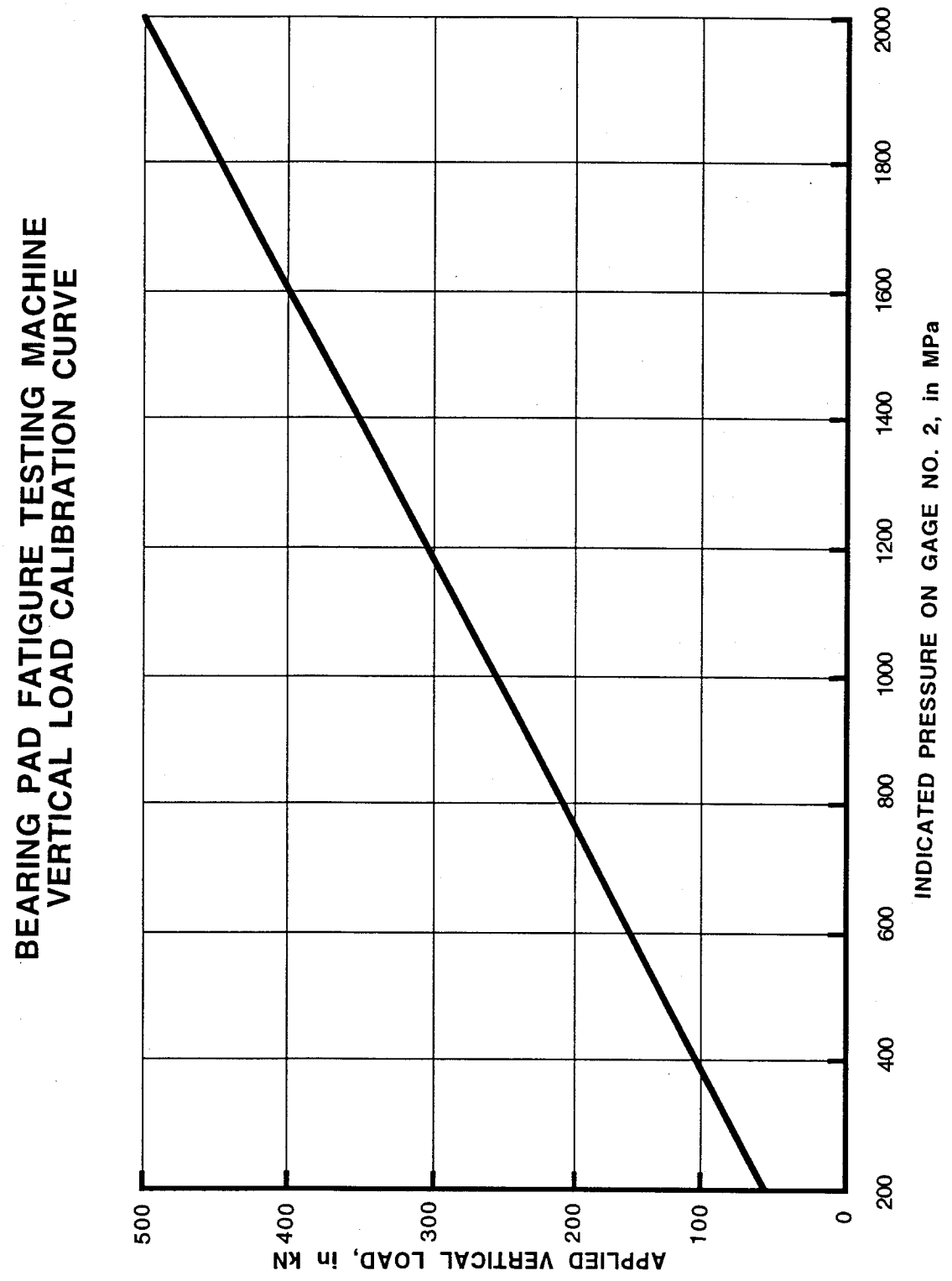

BEARING PAD FATIGURE TESTING MACHINE
VERTICAL LOAD CALIBRATION CURVE
APPLIED VERTICAL LOAD, in KN
0
100
200
300
400
500
INDICATED PRESSURE ON GAGE NO. 2, in MPa
200
400
600
800
1000
1200
1400
1600
1800
2000

FIGURE 4

TRANSPORTATION LABORATORY

FATIGUE AND COEFFICIENT OF FRICTION TEST DATA SHEET

TYPE: _____

SIZE: _____

DATE: _____ LOAD: _____

STROKE: _____ SPEED: _____

DRAWING OF SPECIMEN

CYCLES	SPEED mm/min.	+ READING	− READING	MOVING AVERAGE	GAGE PRESSURE	n TONNES	+f TONNES	−f TONNES	MOVING f TONNES	+U	−U	THICKNESS (mm)	REMARKS

TL - 6028

FIGURE 5

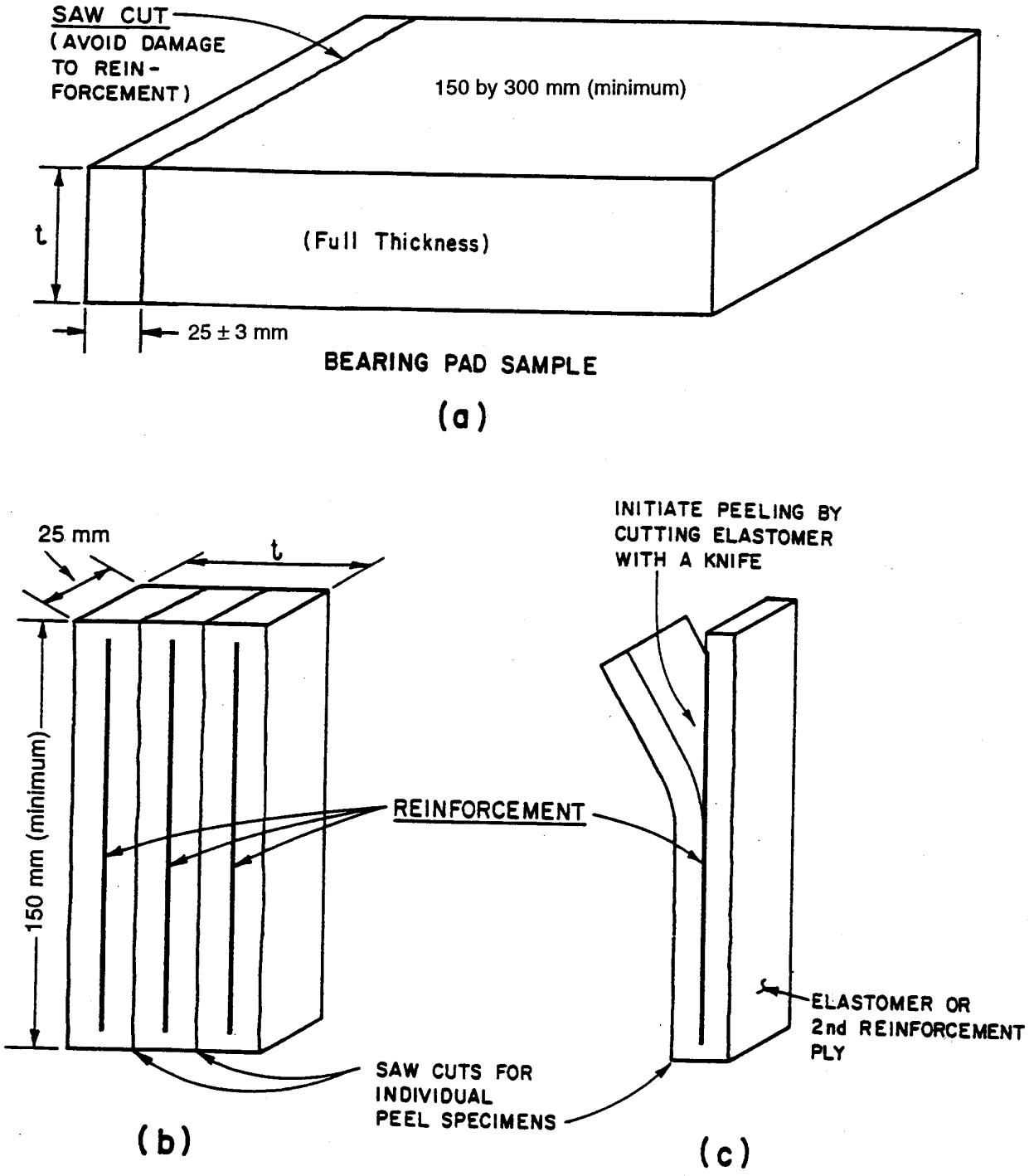

SAW CUT
(AVOID DAMAGE TO REIN-FORCEMENT)
150 by 300 mm (minimum)
t
(Full Thickness)
25 ± 3 mm
BEARING PAD SAMPLE
(a)
25 mm
t
150 mm (minimum)
REINFORCEMENT
SAW CUTS FOR INDIVIDUAL PEEL SPECIMENS
(b)
INITIATE PEELING BY CUTTING ELASTOMER WITH A KNIFE
ELASTOMER OR 2nd REINFORCEMENT PLY
(c)

FIGURE 6

PEEL TEST

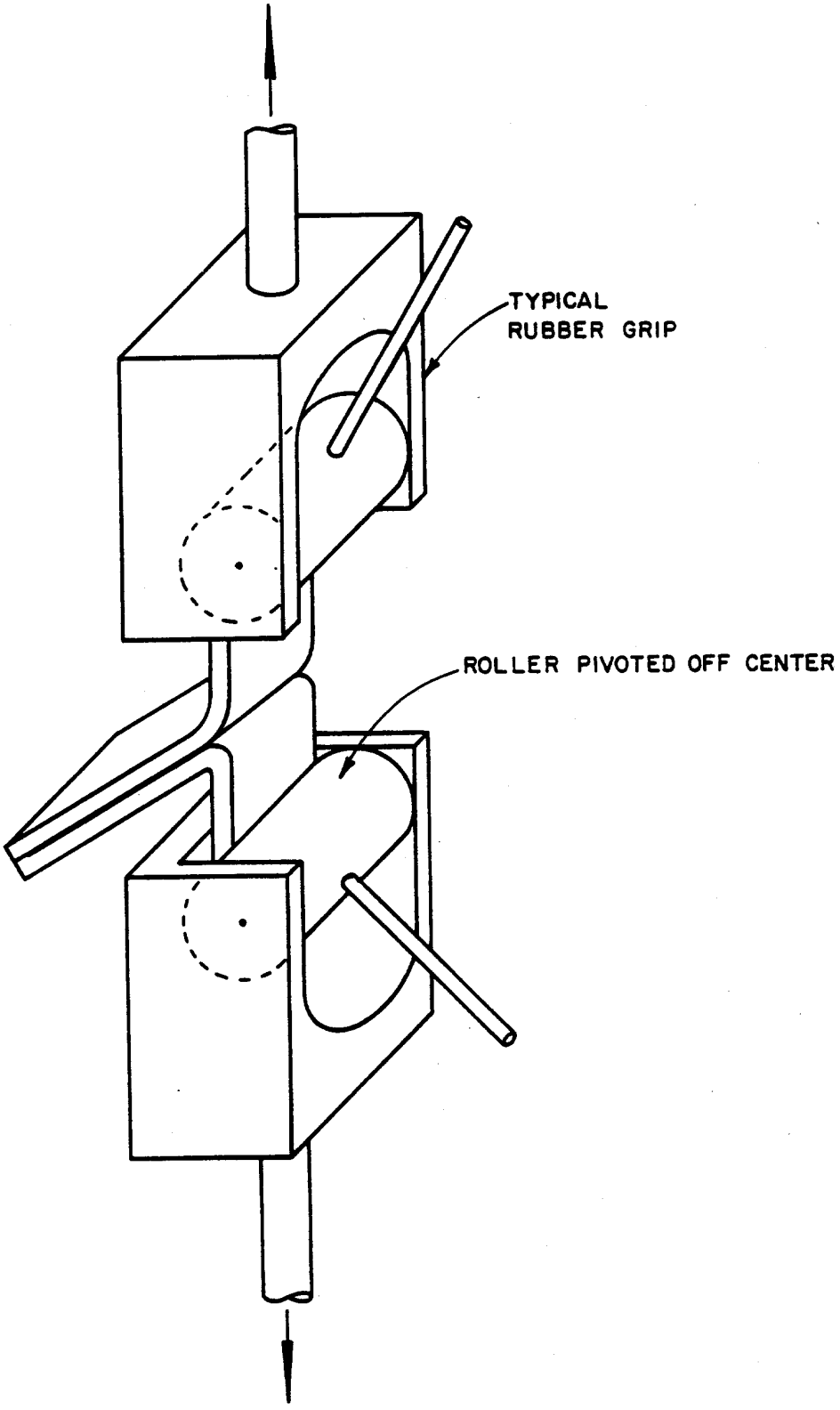


FIGURE 7